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(54) **Reeling drum**

Aufwickelhülse

Mandrin d'enroulement

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Description

The invention concerns a reeling drum for a paper or board machine or equivalent, onto which reeling drum a material web, in particular paper or board, is reeled, axle journals having been fixed to the ends of the reeling drum by means of end joints, by means of which axle journals the reeling drum is supported revolvingly on the machine frame by means of bearing means.

The paper produced in a paper machine is wound around a reeling drum in a reel-up to make a jumbo roll. The commonest type in use is a reel-up driven from the circumference, wherein the reeling drum revolves against a reeling cylinder. With the present-day reeling drums provided with rubber coating or polyurethane coating, the control of the linear load is indefinite at the bottom of the roll. In the present reeling drums, the hardness of the roll face and the properties of compressibility are quite decisively different from the corresponding properties of paper, which has the consequence that, when the reeling is started on an empty reeling drum, the desired distribution of hardness and density of the reeled paper is not attained. It is a further significant problem, in particular in the case of LWC- and SC-papers, that such papers form very dense rolls on the reeling drum, which rolls are also rigid. The reeling drum is, however, deflected because of the load, and, since the rigid paper roll present on the reeling drum cannot deflect to a corresponding extent, the pressure produced by the paper roll on the reeling drum is considerably higher at the edges of the reeling drum than in its middle area. These drawbacks produce web breaks and roll-bottom broke in the reeling, and the amount of broke in one roll may be of an order of up to 2000 metres. Thus, in a paper mill, the annual losses incurred because of broke amount even to dozens of millions of FIM. In prior art, attempts have been made to eliminate the problems arising from deflection of the reeling drum and from the resulting unfavourable distribution of pressure so that the diameter of the reeling drum has been made larger. In this way, of course, the effect has been achieved that the deflection of the reeling drum has been reduced, whereby the differences in the pressure distribution on the reeling drum are lower accordingly. However, it is a major drawback of this solution that onto a reeling drum with a large diameter it has not been possible to reel an equally large amount of paper as earlier. Thus, this solution also causes losses for the paper mills because of smaller paper rolls.

FR-A-1 404 122, which forms the basis of the precharacterizing portion of claim 1, discloses a reeling drum for fabric comprising elastic discs for supporting the mantle of the drum on an inner axle.

The object of the present invention is to provide a reeling drum by whose means the above drawbacks related to the prior art are avoided or at least significantly reduced. In view of achieving this, the invention is mainly characterized by the features in claim 1.

The most remarkable advantage of the invention over the prior art is therein that, by means of a solution in accordance with the invention, the pressure arising from the load of the paper roll on the reeling drum can be made substantially more uniform, in which case bottom broke is not formed to a corresponding extent. A second remarkable advantage is therein that onto a reeling drum in accordance with the invention it is possible to reel a considerably larger amount of paper or board than in prior art. The other advantages and characteristic features of the invention will come out from the following detailed description of the invention.

Figure 1 is a fully schematic sectional view of a first alternative embodiment of a reeling drum in accordance with the invention.

Figure 2 is an illustration corresponding to Fig. 1 of a second alternative embodiment of the invention.

Figure 3 is a schematic graphic illustration of the pressure produced by the paper roll on the reeling drum.

In Fig. 1, the reeling drum is denoted generally with the reference numeral 10. The reeling drum 10 comprises an inner mantle 11, to both of whose ends the axle journals 13 are fixed by means of end joints 12, the reeling drum 10 being mounted on the machine frame on said axle journals 13. Thus, in a reeling drum 10 in accordance with the invention, the inner mantle 11 acts as the member that receives and carries the loads applied to the reeling drum. In the solution in accordance with the invention, onto the inner mantle 11, an outer mantle 14 of larger diameter has been fitted so that a gap remains between the inner mantle 11 and the outer mantle 14, which gap permits deflection of the inner and the outer mantles 11, 14 in relation to one another. The object of this solution is that, by means of the outer mantle 14, the deflection of the inner 11 mantle arising from the load should be compensated for as well as possible. Thus, the reeling drum 10 in accordance with the invention is provided with crown variation.

As is shown in Fig. 1, the outer mantle 14 is supported on the inner mantle 11 by means of articulation devices 15. The articulation devices 15 are placed along the axial length of the reeling drum 10 so that they are placed at a distance from the ends of the outer and the inner mantles 11, 14. As the optimal locations of the articulation devices 15 in the axial direction can be considered the Bessel points, but, in practice, said articulation devices 15 can be placed at some points between the mantle ends and the Bessel points. The construction of the articulation devices 15 is such that, in an axial section as shown in Fig. 1, they permit deflection of the inner and the outer mantles 11, 14 in relation to one another. The articulation devices 15 may be substantially torsionally rigid, in which case they prevent rotation of the inner and the outer mantles 11, 14 in relation to one another, or the articulation devices 15 may be roller bearings or slide bearings, in which case they permit free rotation of the outer mantle 14 around the inner mantle 11. The articulation devices 15 consist of an

outer ring 15a connected to the outer mantle 14, of an inner ring 15b connected to the inner mantle 11, and of a joint member 15c interconnecting the inner and the outer rings. The joint member 15c may be, e.g., of rubber or equivalent, which is fixed by vulcanizing onto the inner and the outer rings of the articulation devices 15. The articulation devices 15 can be fixed to the inner and the outer mantles 11, 14 of the reeling drum in some suitable way, and in Fig. 1 this has been accomplished so that, on the middle portion of the inner mantle 11 and, correspondingly, on the middle portion of the outer mantle 14, thicker portions 16, 17 have been formed, which are thicker than the end areas of the inner and the outer mantles 11, 14. At the points of installation of the articulation devices 15, between the end areas of the mantles and the thicker portions 16, 17, conical faces 18, 19 have been formed so that the articulation devices 15 have been attached to the inner and the outer mantles 11, 14 by means of conical joints.

In Fig. 2, a second alternative embodiment of a reeling drum in accordance with the invention is shown. In Fig. 2, the reeling drum is denoted generally with the reference numeral 20 and, in a way corresponding to Fig. 1, the reeling drum 20 comprises an inner mantle 21, to whose ends the axle journals 23 have been fixed by means of end joints 22, the reeling drum 20 being mounted on the machine frame on said axle journals 23. On the inner mantle 21, an outer mantle 24 is mounted coaxially, being supported on the inner mantle 21 by means of articulation devices 25. The operation and the locations of the articulation devices are similar to those of the articulation devices 15 in Fig. 1. Thus, the articulation devices 25 shown in Fig. 2 comprise an outer ring 25a attached to the outer mantle 24, an inner ring 25b attached to the inner mantle 21, and joint members 25c interconnecting the outer and the inner rings 25a,25b and permitting deflection of the inner and the outer mantle 21,24 in relation to one another. Torsionally rigid articulation devices 25 prevent rotation of the inner and the outer mantle 21,24 in relation to one another, or the articulation devices 25 may be roller bearings or slide bearings, in which case they permit free rotation of the outer mantle 24 around the inner mantle 21. Fig. 2 differs from the embodiment of Fig. 1 in the respect that, in Fig. 2, the inner and the outer mantles 21,24 are formed as of uniform thickness in the axial direction, without thicker portions. The articulation devices 25 are attached to the inner and the outer mantles in some suitable way.

Fig. 3 is a schematic and graphic presentation of the effect produced by means of the solution in accordance with the invention as compared with prior-art solutions. In the graphic presentation in Fig. 3, the vertical axis represents the relative pressures produced by the load on the reeling drum and, in a corresponding way, the horizontal axis represents the relative axial length of the outer mantle, i.e. the width of the roll. The curve denoted with the reference D in Fig. 3 represents a conventional single-mantle reeling drum, whose diameter is 825 mm. Onto this reeling drum, paper has been reeled so that the diameter of the paper roll is 2700 mm, which is an ordinary roll size used in reeling. As can be seen from the figure, the load and the pressure produced by the roll on the reeling drum is, at the ends of the roll, a multiple of the load in the middle area.

In the figure, the curve denoted with the reference C represents a conventional single-wire reeling drum that has a larger diameter, 1220 mm. In the case denoted with the reference C, paper web has been reeled onto the reeling drum so that the diameter of the roll is 3400 mm. As can be seen, in the case C, it has been possible to lower the peak pressures occurring at the roll ends as compared with the case D, but, nevertheless, the pressures effective at the ends are substantially higher than in the middle areas. It is a further drawback of the case C that it has been necessary to increase the diameter size of the roll considerably even though the amount of paper web reeled has, however, not increased to a considerable extent, because the diameter of the reeling drum is substantially larger than normally.

In Fig. 3, the curves denoted with the references A and B represent a reeling drum in accordance with the invention, and the points denoted with the references F on the curves A and B mean the points of location of the articulation devices on the reeling drum. In the case denoted with the reference A, the diameter of the outer mantle of the reeling drum in accordance with the invention is 825 mm, and paper has been reeled onto the reeling drum so that the diameter of the roll is 2700 mm. As is shown in Fig. 3, by means of the solution of the invention (case A), a considerable reduction of the peak pressures is achieved as compared with the reeling drums of normal constructions (case D), the pressure produced by the load being substantially uniform across the roll width with a reeling drum in accordance with the invention.

In the case denoted with the reference B, the diameter of the outer mantle of the reeling drum in accordance with the invention is still 825 mm, but in the case of the curve B, paper web has been reeled onto the reeling drum so that the diameter of the roll is 3400 mm. In the case B in accordance with the invention, the pressures and the loads are substantially lower and more uniform as compared with the conventional reeling drums (cases C and D). From Fig. 3, it should be noticed further that, in the alternative in accordance with the invention (case B), the amount of paper in the roll is substantially larger than on the conventional reeling drum (case C), even though the diameter is the same in these cases. This comes from the fact, as was already stated above, that, in the case B in accordance with the invention, the diameter of the reeling drum is smaller than in the conventional case C. Thus, by means of the invention, a considerable improvement is achieved over the prior art both in respect of the loading and in the respect that a larger amount of paper can be reeled onto the reeling drum than in prior art.

Above, the invention has been described by way of example with reference to the figures in the accompanying drawing.

Claims

1. Reeling drum for a paper or board machine or equivalent, onto which reeling drum (10,20) a material web, in particular paper or board, is reeled, axle journals (13,23) being fixed to the ends of the reeling drum (10,20) by means of end joints (12,22), by means of which axle journals (13,23) the reeling drum (10,20) is supported revolvingly on the machine frame by bearing means, the reeling drum (10,20) being provided with means (11,14,15; 21,24,25) for variation of the deflection of the reeling drum (10,20) and for equalization of the pressure produced by the material web reeled onto the reeling drum (10,20), **characterized** in that the reeling drum (10,20) comprises an inner mantle (11,21), which is supported on the machine frame revolvingly, and an outer mantle (14,24), which is fitted on said inner mantle (11,21) coaxially, so that a gap remains between the inner mantle (11,21) and the outer mantle (14,24), the outer mantle (14,24) being supported on the inner mantle (11,21) by means of articulation devices (15,25), consisting of roll bearings, slide bearings or torsionally rigid means.

2. Reeling drum as claimed in claim 1, **characterized** in that the outer mantle (14,24) is supported on the inner mantle (11,21) by means of the articulation devices (15,25) at two points, which are placed at a distance from both ends of the reeling drum (10,20) towards the middle part of the reeling drum.

3. Reeling drum as claimed in any of the preceding claims, **characterized** in that the articulation devices (15,25) are placed at the Bessel points calculated from the ends of the reeling drum (10,20).

4. Reeling drum as claimed in any of the preceding claims, **characterized** in that the articulation devices (15,25) permit deflection of the inner and the outer mantles (11,14; 21,24) of the reeling drum in relation to one another but prevent their rotation in relation to one another.

5. Reeling drum as claimed in any of the claims 1 to 3, **characterized** in that the articulation devices (15,25) permit deflection of the inner and the outer mantles (11,14; 21,24) of the reeling drum in relation to one another and rotation of the outer mantle (14;24) in relation to the inner mantle (11;21).

6. Reeling drum as claimed in any of the preceding claims, **characterized** in that the articulation devices (15,25) are attached to the inner mantle (11,21) and/or to the outer mantle (14,24) by means of conical joints.

7. Reeling drum as claimed in any of the preceding claims, **characterized** in that the inner mantle (11,21) and/or the outer mantle (14,24) is formed substantially thicker in the area between the articulation devices (15,25) as compared with the end areas.

8. Reeling drum as claimed in any of the claims 1 to 6, **characterized** in that the inner mantle (11,21) and/or the outer mantle (14,24) of the reeling drum (10,20) has uniform thickness substantially over its entire axial length.

9. Reeling drum as claimed in any of the preceding claims, **characterized** in that the articulation devices (15,25) comprise an outer ring (15a,25a) attached to the outer mantle (14,24) of the reeling drum, an inner ring (15b,25b) attached to the inner mantle (11,21), and a joint member (15c,25c) that interconnects the inner and the outer rings.

10. Reeling drum as claimed in claim 9, **characterized** in that the joint member (15c,25c) in a torsionally rigid articulation means (15,25) is made of rubber or equivalent, which has been fixed by vulcanization or in an equivalent way to the outer and the inner rings of the articulation device.

Patentansprüche

1. Aufwickelhülse für eine Papier- oder Kartonmaschine oder dergleichen, auf welche Aufwickelhülse (10, 20) eine Materialbahn, insbesondere Papier oder Karton, aufgewickelt wird, wobei Achszapfen (13, 23) mit Hilfe von Endverbindungen (12, 22) an den Enden der Aufwickelhülse (10, 20) befestigt sind, wobei mit Hilfe der Achszapfen (13, 23) die Aufwickelhülse (10, 20) durch Lagereinrichtungen drehbar an dem Maschinenrahmen abgestützt ist, wobei die Aufwickelhülse (10, 20) mit Einrichtungen (11, 14, 15; 21, 24, 25) für eine Variation der Auslenkung der Aufwickelhülse (10, 20) und für einen Ausgleich des Druckes versehen ist, der durch die auf die Aufwickelhülse (10, 20) aufgewickelte Materialbahn erzeugt wird, **dadurch gekennzeichnet, daß** die Aufwickelhülse (10, 20) einen drehbar an dem Maschinenrahmen abgestützten Innenmantel (11, 21) und einen Außenmantel (14, 24) aufweist, der koaxial an dem Innenmantel (11, 21) angebracht ist, so daß zwischen dem Innenmantel (11, 21) und dem Außenmantel (14, 24) ein Spalt verbleibt, wobei der Außenmantel (14, 24) mit Hilfe von aus Wälzlagern, Gleitlagern oder torsionssteifen Einrichtungen bestehenden Gelenkverbindungsvorrichtungen (15, 25) an dem Innenmantel (11, 21) abgestützt ist.

2. Aufwickelhülse nach Anspruch 1, **dadurch gekennzeichnet, daß** der Außenmantel (14, 24) mit Hilfe der Gelenkverbindungsvorrichtungen (15, 25) an zwei Punkten an dem Innenmantel (11, 21) abgestützt ist, die in Richtung auf das Mittelteil der Aufwickelhülse in einem Abstand von beiden Enden der Aufwickelhülse (10, 20) angeordnet sind.

3. Aufwickelhülse nach einem der vorangegangenen Ansprüche, **dadurch gekennzeichnet, daß** die Gelenkverbindungsvorrichtungen (15, 25) an den von den Enden der Aufwickelhülse (10, 20) aus berechneten Bessel-Punkten angeordnet sind.

4. Aufwickelhülse nach einem der vorangegangenen Ansprüche, **dadurch gekennzeichnet, daß** die Gelenkverbindungsvorrichtungen (15, 25) eine Auslenkung des Innen- und des Außenmantels (11, 14; 21, 24) der Aufwickelhülse in Beziehung zueinander gestatten, jedoch deren Drehung in Beziehung zueinander verhindern.

5. Aufwickelhülse nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, daß** die Gelenkverbindungsvorrichtungen (15, 25) eine Auslenkung des Innen- und des Außenmantels (11, 14; 21, 24) der Aufwickelhülse in Beziehung zueinander und eine Drehung des Außenmantels (14; 24) in Beziehung zu dem Innenmantel (11; 21) gestatten.

6. Aufwickelhülse nach einem der vorangegangenen Ansprüche, **dadurch gekennzeichnet, daß** die Gelenkverbindungsvorrichtungen (15, 25) mit Hilfe konischer Verbindungen an dem Innenmantel (11, 21) und/oder dem Außenmantel (14, 24) angebracht sind.

7. Aufwickelhülse nach einem der vorangegangenen Ansprüche, **dadurch gekennzeichnet, daß** der Innenmantel (11, 21) und/oder der Außenmantel (14, 24) im Vergleich mit den Endbereichen in dem Bereich zwischen den Gelenkverbindungsvorrichtungen (15, 25) wesentlich dicker ausgebildet ist.

8. Aufwickelhülse nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, daß** der Innenmantel (11, 21) und/oder der Außenmantel (14, 24) der Aufwickelhülse (10, 20) im wesentlichen über seine gesamte Axiallänge eine gleichmäßige Dicke aufweist.

9. Aufwickelhülse nach einem der vorangegangenen Ansprüche, **dadurch gekennzeichnet, daß** die Gelenkverbindungsvorrichtungen (15, 25) einen an dem Außenmantel (14, 24) der Aufwickelhülse angebrachten Außenring (15a, 25a), einen an dem Innenmantel (11, 21) angebrachten Innenring (15b, 25b), und ein den Innen- und den Außenring miteinander verbindendes Verbindungselement (15c, 25c) aufweisen.

10. Aufwickelhülse nach Anspruch 9, **dadurch gekennzeichnet, daß** das Verbindungselement (15c, 25c) in einer torsionssteifen Gelenkverbindungseinrichtung (15, 25) aus Gummi oder dergleichen angefertigt ist, die durch Vulkanisierung oder in einer gleichartigen Weise an dem Außen- und dem Innenring der Gelenkverbindungsvorrichtung befestigt worden ist.

Revendications

1. Mandrin d'enroulement pour machine à papier ou à carton ou équivalente, sur lequel mandrin d'enroulement (10,20) est enroulée une bande de matière, en particulier du papier ou du carton, des paliers (13,23) d'arbre étant fixés aux extrémités du mandrin d'enroulement (10,20) par l'intermédiaire de joints d'assemblage (22,22) d'extrémités, paliers (13,23) d'arbre par l'intermédiaire desquels le mandrin d'enroulement (10, 20) est supporté de manière rotative sur le bâti de la machine par un moyen formant palier, le mandrin d'enroulement (10,20) étant pourvu de moyens (11,14,15 ; 21,24,,25) pour modifier le fléchissement du mandrin d'enroulement (10,20) et pour égaliser la pression produite par la bande de matière enroulée sur le mandrin d'enroulement (10,20), caractérisé en ce que le mandrin d'enroulement (10,20) comporte une chemise intérieure (11,21) supportée de manière rotative sur la bâti de la machine, et une chemise extérieure (14,24) disposée coaxialement sur ladite chemise intérieure (11,21), de façon qu'il reste un interstice entre la chemise intérieure (11,21) et la chemise extérieure (14,24), la chemise extérieure (14,24) étant supportée sur la chemise intérieure (11,21) par l'intermédiaire de dispositifs d'articulation (15,25), constitués par des roulements à rouleaux, des paliers lisses ou des moyens rigides en torsion.

2. Mandrin d'enroulement selon la revendication 1, caractérisé en ce que la chemise extérieure (14,24) est supportée sur la chemise intérieure (11,21), par l'intermédiaire des dispositifs d'articulation (15,25), en deux points placés à une certaine distance des deux extrémités du mandrin d'enroulement (10,20) vers la partie médiane du mandrin d'enroulement.

3. Mandrin d'enroulement selon l'une quelconque des revendications précédentes, caractérisé en ce que les dispositifs d'articulation (15,25) sont placés aux points Bessel calculés à partir des extrémités du mandrin d'enroulement (10,20).

4. Mandrin d'enroulement selon l'une quelconque des revendications précédentes, caractérisé en ce que

les dispositifs d'articulation (15,25) permettent le fléchissement des chemises intérieure et extérieure (11,14 ; 21,24) du mandrin d'enroulement l'une par rapport à l'autre mais empêchent leur rotation l'une par rapport à l'autre.

5. Mandrin d'enroulement selon l'une quelconque des revendications 1 à 3, caractérisé en ce que les dispositifs d'articulation (15,25) permettent un fléchissement des chemises intérieure et extérieure (11,14 ; 21,24) du mandrin d'enroulement l'une par rapport à l'autre et la rotation de la chemise extérieure (14 ;24) par rapport à la chemise intérieure (11 ;21).

6. Mandrin d'enroulement selon l'une quelconque des revendications précédentes, caractérisé en ce que les dispositifs d'articulation (15,25) sont fixés à la chemise intérieure (11,21) et/ou à la chemise extérieure (14,24) à l'aide de joints d'assemblage coniques.

7. Mandrin d'enroulement selon l'une quelconque des revendications précédentes, caractérisé en ce que la chemise intérieure (11,21) et/ou la chemise extérieure (14,24) est sensiblement plus épaisse dans la zone entre les dispositifs d'articulation (15,25) que dans les zones des extrémités.

8. Mandrin d'enroulement selon l'une quelconque des revendications 1 à 6, caractérisé en ce que la chemise intérieure (11,21) et/ou la chemise extérieure (14,24) du mandrin d'enroulement (10,20) a une épaisseur uniforme sur toute sa longueur axiale.

9. Mandrin d'enroulement selon l'une quelconque des revendications précédentes, caractérisé en ce que les dispositifs d'articulation (15,25) comportent une bague extérieure (15a,25a) fixée à la chemise extérieure (14,24) du mandrin d'enroulement, une bague intérieure (15b,25b) fixée à la chemise intérieure (11,21), et un élément d'assemblage (15c,25c) qui relie l'une à l'autre les bagues intérieure et extérieure.

10. Mandrin d'enroulement selon la revendication 9, caractérisé en ce que l'élément d'assemblage (15c,25c) dans un moyens d'articulation (15,25) rigide en torsion est en caoutchouc ou équivalent, qui a été fixé par vulcanisation ou de manière équivalente aux bagues extérieure et intérieure du dispositif d'articulation.

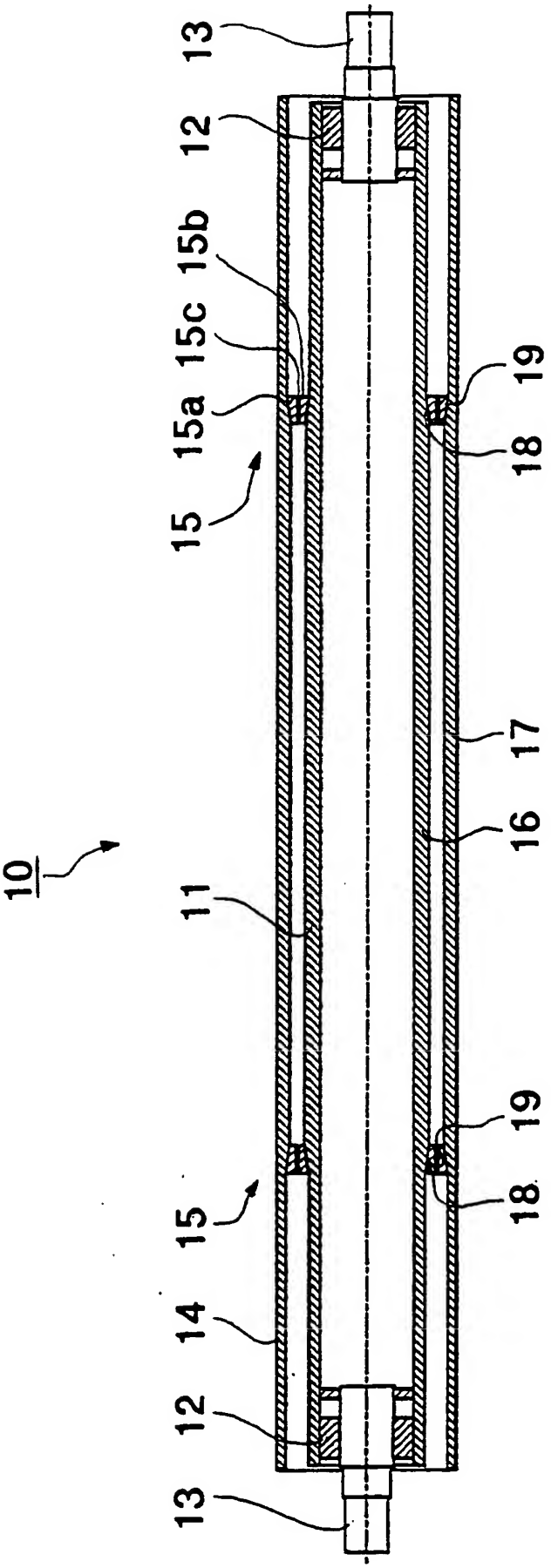

FIG.1

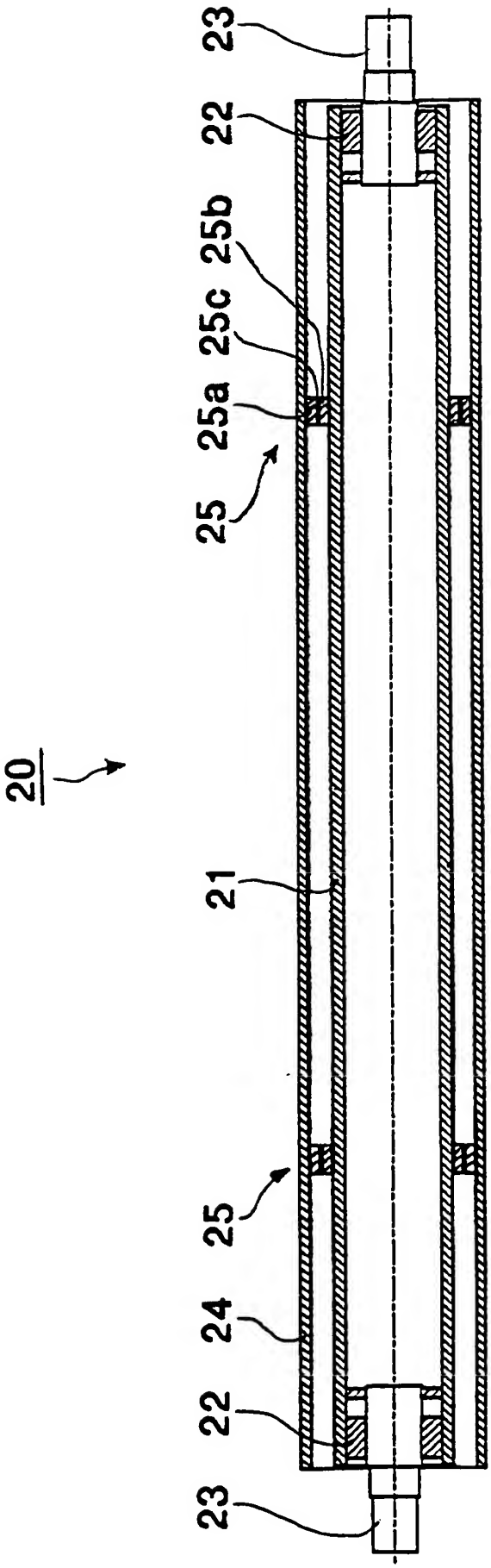

FIG.2

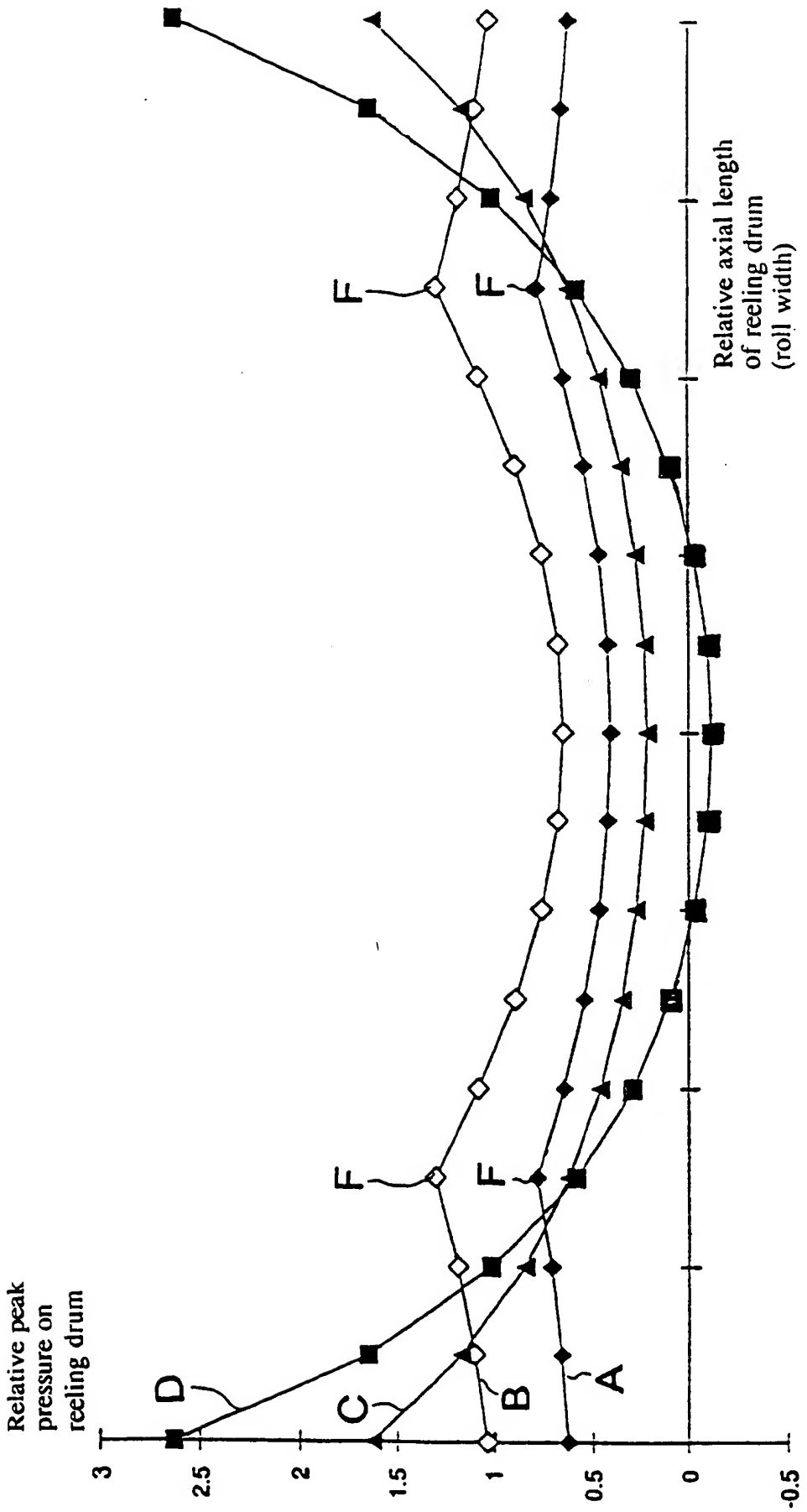
Relative peak pressure on reeling drum
3
2.5
2
1.5
1
0.5
0
-0.5
D
C
B
A
F
F
F
F
Relative axial length of reeling drum (roll width)

FIG.3